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THESIS

AN ANALYSIS OF THE
MATERIEL FIELDING PLAN
FOR THE SINCGARS RADIO

by

Carl M. Tegen

December 1984

Thesis Advisor: D. V. Lamm

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views with personnel in the functional management areas of the Communications and Electronics Command (CECOM), the Project Office, and the Department of Army Staff. Potential problems identified concern the redistribution of VRC-12 series and PRC-77 radios, the imbedded COMSEC modification, and the issue of warranties. Recommendations include purchasing a warranty for the original production contract, improving the planning for redistribution of old radios, and providing strict control over the design of the imbedded COMSEC modification.

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An Analysis of the Materiel Fielding Plan For the SINCGARS Radio

by

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Captain, United States Army
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Submitted in partial fulfillment of the requirements for the degree of

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from the

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December 1984

ABSTRACT

This thesis is an analysis of the Materiel Fielding Plan (MFP) for the Army's Single Channel Ground and Airborne Radio System (SINCGARS). Objectives of the study are to identify major potential problem areas in the Materiel Fielding Plan, and to generate recommendations for resolving these problems. The study involves a specific analysis of the maintenance and supply support aspects of the MFP within the context of the Major System acquisition framework. Research included extensive field interviews with personnel in the functional management areas of the Communications and Electronics Command (CECOM), the Project Office, and the Department of Army Staff. Potential problems identified concern the redistribution of VRC-12 series and PRC-77 radios, the imbedded COMSEC modification, and the issue of warranties. Recommendations include purchasing a warranty for the original production contract, improving the planning for redistribution of old radios, and providing strict control over the design of the imbedded COMSEC modification.

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I. INTRODUCTION

A. FOCUS OF THIS STUDY

Annual appropriations for United States Army Procurement will continue to exceed $19 billion during the period 1985-1990, with the bulk of these funds being spent on projects designated as "Major Weapon Systems." The Single Channel Ground and Airborne Radio System (SINCGARS) is one of 40 Army Major Weapon Systems, and is designed to replace the Very High Frequency (VHF), combat net radio now in use. This is the most significant step taken to improve the combat communications capabilities of the Army in 30 years. More than $10 billion (FY 83) will be spent to acquire, field, and operate over 277,000 radios in virtually every unit throughout the Army, as well as the other three services [Ref. 1: p. D3 and 2: p. 718],

The initial production contract, with the Aerospace/Optical Division of International Telephone and Telegraph (ITT) was signed on 2 December 1983, for the first 650 units. It included options to buy a total of 43,950 additional radios during program years two, three, and four. The acquisition strategy calls for ITT to qualify a second source by 1985, and to raise production to a rate of 16,000 per year by 1987.

Radios from the first production lot will be fielded in February 1986 [Ref. 3: p. DA-1]. Preliminary planning for the fielding effort is complete, and is contained in the Materiel Fielding Plan (MFP), which was released by the SINCGARS Project Manager in February 1984.

B. OBJECTIVES

The purpose of this research is to examine the Materiel Fielding Plan (MFP) for the SINCGARS Ground System. The objectives are to learn how the Materiel Fielding Plan works, and to identify major potential problem areas. Furthermore, the study will attempt to identify and analyze any possible problems involved in the MFP, and to generate recommendations for resolving them.

The intent is to look at the SINCGARS fielding effort from a new perspective. A particular emphasis will be placed on researching potential unknowns in terms of additional resource requirements.

C. RESEARCH QUESTIONS

Consistent with these objectives, the research focuses on the following questions:

1. Primary Research Question

What are the major potential problems in the System Support Area of the Materiel Fielding Plan for the SINCGARS ground radio system and how might these problems be addressed?

2. Subsidiary Research Questions

a. What are the principal characteristics of the Materiel Fielding Plan for the SINCGARS Ground Radio System?

b. What is the maintenance concept for SINCGARS, and how can it be implemented?

c. What are the warranty/guaranty features and how will these be enforced?

d. What are the key aspects of supply support for SINCGARS, and what are the implications in terms of spare parts acquisition?

e. What resource requirements have yet to be identified?

f. How might the problems identified in the maintenance and supply support planning be addressed and resolved?

D. RESEARCH METHODOLOGY

The first phase of research involved a comprehensive review of the Department of Defense (DoD) and Army policy concerning major system acquisition. Sources of information included Congressional Reports, Government Accounting Office reports, instructions, regulations at all levels, and periodicals dealing with the acquisition process.

The second phase of the research involved an analysis of the SINCGARS project with respect to the DoD acquisition framework. The major potential problem areas were identified during extensive field interviews with personnel in the functional management areas of the Communications and Electronics Command (CECOM), the Project Office, and the Department of Army Staff. These problem areas were analyzed with respect to the existing policy and guidance for weapon system acquisition.

E. SCOPE OF THE STUDY

The scope of the study has been restricted to the maintenance and supply support aspects of the Materiel Fielding Plan (MFP). Training and documentation issues have not been addressed at this time. While there are important questions remaining regarding the doctrinal employment of the radios, this research will not attempt to treat these issues in detail. However, it will be shown that doctrinal decisions have significant impact on the Materiel Fielding Plan.

During the Army System Acquisition Review Council (ASARC) of September 1983, direction was given to restart

development of a single band version of Airborne SINCGARS in order to minimize the "time gap" between the ground and aircraft radio availability. [Ref. 1: p. 3]. This study has not specifically addressed the Materiel Fielding Plan for the Airborne version, although some of the related issues will be discussed in Chapters IV and V.

F. ASSUMPTIONS

The study assumes that the reader has a basic understanding of the Federal Government acquisition process. Additionally, it is assumed that the reader has a basic understanding of the Army Materiel Command (AMC) and its structure with regard to the acquisition process.

G. DEFINITIONS

Materiel Fielding - The management function which focuses on the "handoff" of a fully developed item/system from the Materiel Developer to the User.

Integrated Logistics Support Plan - Provides a composite of all support considerations necessary to assure the effective and economical support of a system for its life cycle, and serves as the source document for summary and consolidated information required in other documents of the program management documentation.

Life Cycle Cost - The total cost to the Government for the development, acquisition, operation, support, and disposal of an item/system over a defined life span.

Maintenance Concept - Constitutes a series of statements and/or illustrations defining criteria covering maintenance levels, major functions accomplished at each level of maintenance, basic support policies, effectiveness factors, and primary logistic support requirements.

H. ORGANIZATION OF THE STUDY

The study begins in Chapter II with a summarization of the framework and background in which the Materiel Fielding Plan has been developed. An understanding of the overall

Department of Defense policy and guidance for developing and procuring major weapon systems is necessary. From this base, it is possible to examine how the SINCGARS logistics considerations were incorporated in the SINCGARS design, and in turn, how these considerations impact the fielding of the SINCGARS system.

Chapter II also includes a section on background information which provides an historical perspective on the SINCGARS project. A chronology of key events and a description of program evolution sets the stage for specific analysis of maintenance and supply support considerations.

A descriptive summary of the Materiel Fielding Plan is provided in Chapter III. This chapter delineates the principal characteristics of the Materiel Fielding Plan, focusing on maintenance and supply support considerations. An examination of the Materiel Fielding Plan suggests many issues which are then examined in detail in Chapters IV and V.

Chapter IV examines the development of the maintenance concept in the context of the Department of Defense acquisition framework discussed in Chapter II. The analysis also determines how well the Materiel Fielding Plan evolved from the maintenance concept. Problem areas are then examined in detail.

Because supply support aspects of the SINCGARS Materiel Fielding Plan are strongly related to the maintenance concept, Chapter V examines a number of potential supply support issues with respect to their impact on the fielding effort. Again, the analysis is focused on how the SINCGARS fielding plan fits into the context of the Department of Defense acquisition framework.

In Chapter VI, the potential major problems which have been identified are recapped and possible alternative courses of action are discussed. The final chapter then

presents conclusions and recommended actions for resolution of problem areas identified.

II. FRAMEWORK AND BACKGROUND

A. INTRODUCTION

Over the past decade, the United States Army has begun an aggressive force modernization campaign. Numerous new weapon systems have been fielded, and many more are on the way. During the Viet Nam War, the Army came to realize that the fielding process is a critical step in the acquisition process [Ref. 4: pp. 20-58]. Through painful mistakes, the Army found that the process of handing-off a new weapon system from the materiel developer to the user can be very complex and expensive if not properly managed. Problems which surface during fielding often require enormous resources to rectify.

The Materiel Fielding Plan (MFP) is a concept peculiar to the Army. Other services view the fielding process as a subset of the Integrated Logistics Support Plan. This chapter will examine the MFP in the broader context of the acquisition process, and will provide a descriptive account of the SINCGARS program background. The stage will then be set for an analysis of the SINCGARS Materiel Fielding Plan in Chapters IV and V.

B. FRAMEWORK

1. Policy

The Department of Defense policy for acquisition of major weapon systems is grounded in OMB Circular A-109 [Ref. 5]. The guidance for implementation is specified in Department of Defense Directive 5000.1 and Department of Defense Instruction 5000.2. The Department of Defense

endeavors to achieve a number of specific objectives through these documents, as well as several others issued at DoD and Army level. Often these objectives are in conflict and trade-offs must be made. It is useful to summarize the principles and objectives which are discussed in DoD Directive 5000.1 as follows:

1. Effective design and price competition will be used to ensure cost-effective systems which are responsive to mission needs.

2. Improved readiness and sustainability are primary objectives. Operational suitability is of equal importance as operational effectiveness.

3. Stability is necessary for effective, efficient and timely acquisitions. It will be achieved through effective long range planning. Plans will consider economic rates of production, surge capacity, logistics support, and manpower requirements. Evolutionary alternatives will be considered instead of solutions at the frontiers of technology. An acquisition strategy will be developed at the inception of each major acquisition that sets forth the objectives, resources, management assumptions, extent of competition, proposed contract types, and program structure. The acquisition plan will tailor the prescribed steps in the major system acquisition decision-making process to this strategy.

4. Efficiency in the acquisition process will be achieved through delegation of authority and responsibility.

5. A cost-effective balance must be achieved between acquisition costs, ownership costs, and system effectiveness.

6. Standardization and interoperability between the U.S. and its allies, and between services will be maximized.

7. A strong industrial base is a key objective. [Ref. 6: p. 2-3]

It is recognized that many of these objectives compete with each other in a practical sense. Therefore, tradeoffs are acceptable and necessary. Nonetheless, the objectives represent important goals in the Government acquisition process which has been broken down into four distinct phases as follows:

1. Concept Exploration
2. Demonstration and Validation
3. Full-Scale Development
4. Production and Deployment

The acquisition process is such that the transition from one phase to the next is marked by a Milestone, or decision point. At each of these Milestones, an affirmative decision to proceed must be reached by the Secretary of Defense. His decision is based on a review by the Defense Systems Acquisition Review Council (DSARC) which is chaired by the Undersecretary of Defense for Research and Engineering (USDRE) who fills the role of the Acquisition Executive [Ref. 6: p. 5].

Following Concept Exploration, and the decision to move forward into Demonstration and Validation, the Secretary of the Army will normally appoint a Project Manager (PM) to manage all aspects of the acquisition process [Ref. 7: p. 1.19]. The Project Manager becomes the focal point for all of the planning and coordination involved in the new system. The PM maintains a staff of functional area experts and he draws on assets throughout the particular commodity command in a matrix management-type of an organization. Each project office is tailored to meet the needs of the specific project and changes with the acquisition process.

The responsibilities and authority of the Project Manager are extensive. Perhaps the most obvious responsibility of the PM is to fill the role of the system's advocate or proponent [Ref. 7: p. 1.19]. He becomes the motivating force which ensures progress through the phases of the acquisition process. Balanced against the PM's responsibility as advocate is his responsibility to ensure the fielding of a quality product using the limited

resources provided. His responsibilities with regard to Life Cycle Costs (LCC) are particularly important because of the increasing concern over the size of the Defense budget and, more specifically, the sensitive subject of "cost overruns" and affordability. Early in the acquisition process, the PM must develop an Acquisition Strategy which adequately considers affordability as a function of cost, priority, and availability of fiscal and manpower resources [Ref. 6: p. 6]. The acquisition strategy must reflect the principles and objectives of DoD Directive 5000.1 and it must be flexible enough to handle changes in technology, mission needs, and funding [Ref. 6: p. 7].

2. Materiel Fielding Plan

The Army has enhanced its ability to accurately plan for the actual fielding of weapon systems by instituting a requirement for a Materiel Fielding Plan [Ref. 4: p. 22]. The MFP is the principal document around which coordination and agreement on deployment of a new system are accomplished to assure that the gaining command will have sufficient advanced information to budget necessary resources and plan for receipt of the equipment [Ref. 3: p. 10.8]. It forces interaction between the user and the developer early in the Full-Scale Development Phase. This interaction provides valuable feedback to the PM which can have positive impact on design and fielding decisions.

The materiel fielding plan is the total set of actions and events required to manage and execute the initial deployment of new systems and requires advance planning, negotiation, and agreement between the materiel fielder and the gaining Major Command (MACOM). The materiel fielding process was established to achieve an orderly and satisfactory materiel deployment leading to Initial Operational Capability (IOC). The process starts with

initial Integrated Logistic Support (ILS) planning at program initiation. Beginning with early recognition of fielding requirements, constraints, and resource impacts, it evolves into detailed planning and coordination in the full scale development phase.

The extensive force modernization effort now underway within the Army has placed a managerial burden on gaining MACOMs. Poor materiel fielding creates an adverse impact by forcing the gaining MACOM to redirect previously committed resources and personnel to support the modernization item. In the eyes of the gaining MACOM, fielding should not occur unless a total system is available. A well-executed materiel fielding effort is a means of easing this burden.

The term "total system" is intended to include the following:

1. The primary end item including all major component items.

2. All separately authorized support equipment, test measurement and diagnostic equipment (TMDE), and tools.

3. Maintenance and storage facilities.

4. Technical and supply manuals.

5. Repair parts, i.e., Authorized Stockage List/Prescribed Load List (ASL/PLL).

6. New Equipment Training (NET) and training aids.

7. Manpower and personnel.

8. Documentation (Table of Organization and Equipment (TOE) and Modification Table of Organization and Equipment (MTO&E)). [Ref. 9: p. 3]

In order to produce a comprehensive MFP which can deal effectively with each of the "total system" areas above

the fielding considerations must be well-integrated with planning in all other functional areas of the project. Critical to an effective fielding effort, is the concept that materiel fielding is not a subsequent action, which is performed as an afterthought [Ref. 10: p. 29].

3. Testing

To measure how well a project is progressing, developmental and operational tests are conducted. Testing according to a well designed Test and Evaluation Master Plan (TEMP) is a crucial process [Ref. 7: p. 14]. Fielding considerations should be integrated into the TEMP and test results should be closely monitored as they become available to determine their impact on the fielding effort.

The new office of the Director, Operational Test and Evaluation, was assigned responsibility in P.L. 98-84 for approving operational test plans and for reporting to Congress on the effectiveness and suitability for combat of major defense acquisition programs before a final decision is made to proceed beyond low rate initial production (LRIP) [Ref. 11: p. 1]. The definition of LRIP for this purpose is

> production of a system in limited quantity to be used in operational test and evaluation for verification of production engineering and design maturity and to establish a production base prior to a decision to proceed with production.

A decision to enter production without entering LRIP is equivalent to a decision to proceed beyond LRIP.

4. In Summary

Warranty legislation, the requirement for a MFP, and the requirement to obtain approval to proceed beyond LRIP, represent recent initiatives designed to insure that the user gets a quality product. Each initiative is

interrelated with the others, and with the overall acquisition process, but the important concept to grasp is that each initiative requires comprehensive planning and forecasting of future events. It is in the Materiel Fielding Plan that the PM actually attempts to envision what will happen when he places his system in the hands of the user. In this respect, the MFP represents the climax of the acquisition process.

C. BACKGROUND

The Single Channel Ground and Airborne Radio System (SINCGARS) will be the VHF/FM radio communications system providing the primary means of command and control for Infantry, Artillery, and Armor units. It will serve as the principal means of communication in the echelons of the Division between the Brigade and Division Artillery down to platoons and, therefore, is critical to the successful conduct of land battle. SINCGARS will also provide the command and control means to Combat Support and Combat Service Support units of the Army in the field. The SINCGARS family of radios will be capable of transmitting voice, tactical data and record traffic.

SINCGARS replaces the current standard vehicular and manpack radio configurations; the AN/VRC-12 family and the AN/PRC-77. Development of an airborne SINCGARS was initiated in 1978 to replace the AN/ARC-114. This development was deferred in 1981 because of a program funding shortfall and was later terminated in 1982 in favor of acquiring a VHF-AM/FM SINCGARS compatible radio for installation in Army/Air Force aircraft. The airborne version was recently restarted by the Vice Chief of Staff of the Army during the Milestone Decision Review III, on 21 September 1983.

The Required Operational Capability (ROC) document was approved by the Department of the Army in December 1974. (See Figure 2.1) A joint ROC was later approved in 1976. At DSARC I, in February 1976, the SINCGARS program was approved. A development contract to explore Fast Frequency Hopping (FFH) techniques was awarded, as well as two contracts to explore Slow Frequency Hopping (SFH) techniques. Frequency Hopping is a process by which all of the radios in a communications net simultaneously "hop" over a number of preset frequencies. The "hopping" is synchronized among all net members to provide required communications.

The maturity Developmental/Operational tests were conducted and completed during the July-December 1983 timeframe. At that time, it was apparent, at least to the communications audience, that the frequency hopping concept as employed by ITT could accomplish the mission. All of the early developmental testing indicated that the design would be highly successful in avoiding the jamming threat [Ref. 1: p. 11].

The initial production contract for SINCGARS had been envisioned as a four-year multiyear procurement. Congressional notification was required because of the amount of the cancellation ceiling, and this was accomplished in May 1983 [Ref. 1: p. 3]. Although approval was obtained from three of four congressional committees, the House Appropriations Committee (HAC) non-concurred in November 1983 [Ref. 1: p. 3]. Therefore, a single year contract was awarded on 2 December 1983 for 650 units with follow-on options for a total buy of 28,100 units. However, the contract contained a clause allowing the Army to convert to a multiyear contract prior to 31 May 1984 if approved by Congress. A request for reconsideration was forwarded to the HAC in early January 1984, but was denied in June 1984.

Dec	1974	SINCGARS Required Operational Capability approved
Oct	1975	ASARC I
Feb	1976	DSARC I
Jun	1977	VCSA directs program acceleration
Jan	1981	Funding limitation slows development
Aug	1981	Development deferred on aircraft version, COMSEC module, data adapter, secureable remote control unit
Dec	1981	VCSA directed further acceleration
May	1982	USDRE delegated management service authority to the Army
Jul	1983	Maturity Operational Test
Sept	1983	ASARC III - VCSA directs airborne fielding concurrent with ground system - Production decision and Source Selection ratified
Dec	1983	Initial production contract awarded
Feb	1984	MFP released
Sept	1984	Operational Assessment Tests
Oct	1984	DSARC approves 1st year option

Source: Developed by researcher

Figure 2.1 SINCGARS Chronology

It is important to recognize that the decision not to pursue a multiyear approach was a significant change to the acquisition strategy for SINCGARS. The original plan to go multiyear was undoubtedly "built in" to much of the planning for SINCGARS during that period. The effect of this built-in bias is discussed in Chapter IV, particularly with respect to warranties.

A critical decision in the project was made in June 1977. At that time the Vice Chief of Staff directed that the SINCGARS project be accelerated by two to three years [Ref. 1: p. 2]. The resulting concurrency has had some significant impact on supply support which will be discussed in Chapter V.

The 1984 directive by the Director, Operational Test and Evaluation concerning LRIP, was issued subsequent to the initial production award of 650 units. It was determined that SINCGARS did not fall under the purview of this directive because it had already passed the LRIP stage [Ref. 12]. On 19 June 1984 the operational test plan for SINCGARS was approved by DOT&E [Ref. 13]. The test schedule for SINCGARS

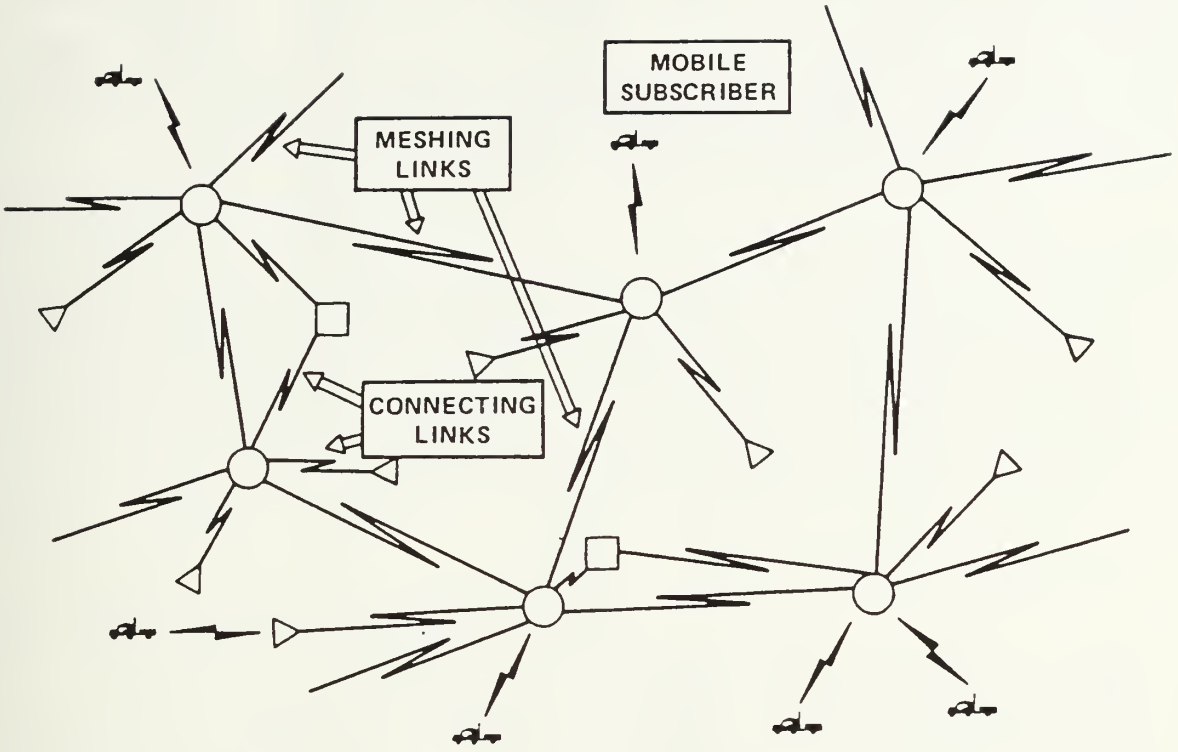
TABLE I
Testing Schedule

Maturity (Operational) Testing	Apr 83 - Dec 83
Operational Assessment Testing	Aug 84 - Dec 84
1st Article Production Test	May 85 - Aug 85
Small Scale Force Development Test and Evaluation (FDTE)	Oct 85 - Mar 86
IOC Unit Testing (Ft. Hood)	Jan 87 - Sep 88

is presented in Table I [Ref. 14: p. 29].

There is one significant problem with the Operational Test Plan. There will not be sufficient quantities of radios to test a division-size unit until 1987. This is more than a year after the first radios will be fielded. Although there have been some extensive computer simulations, it is impossible to perform an actual test of several hundred radios, operating in dozens of nets, until sufficient radios have been produced [Ref. 1: p. E4].

During the maturity operational test (MOT) conducted in 1983, the Army's Operational Test and Evaluation Agency (OTEA) identified specific deficiencies in the Advanced Development Model (ADM) of the SINCGARS radio. The most significant problems centered around the operation of the radio because the man-machine interface was somewhat complex. Additionally, there were some difficulties with synchronization loss and loss of hopset variables. Appropriate changes in design were made during the next 12 months and an operational assessment (O/A) was conducted from 22 August to 21 September 1984 at Ft. Huachuca, Arizona. The results were satisfactory in each of the problem areas identified during the MOT [Ref. 15: p. 9]. While the need for SINCGARS (at brigade and below) has not changed, the Signal Corps in 1983 made a major shift in its philosophy concerning tactical command and control communications above the brigade level. A new family of equipment called the Mobile Subscriber Grid System (MSGS) was envisioned [Ref. 17]. The MSGS system will include switchboards linked by multichannel interconnects covering a geographical area with a grid system, and several mobile telephones, operating throughout the Corps area (See Figure 2.2) [Ref. 18: p. 17]. It will replace virtually all of the communications equipment presently employed in, around, and between headquarters elements above the brigade. The introduction of MSGS represents a major metamorphosis of the



Source: Pro-RITA Corporation

Figure 2.2 Mobile Subscriber Grid System

Signal Corps hardware. The shift to MSGS will require a complete reorganization of all Division signal battalions, and Corps signal brigades [Ref. 19: p. 5-1]. It is not clear at this time, the extent to which MSGS equipment might supercede the need for a limited number of SINCGARS.

Since MSGS fielding is planned to occur almost simultaneously with the introduction of SINCGARS, the fielding effort for SINCGARS must be considered within the broader context of a rapidly changing Signal Corps. It must be recognized that MSGS will compete for resources within the Signal Corps, and within the Army at large. The Army has committed itself to making two tremendous changes in

equipment at the same time; SINCGARS and MSGS. Because the impact of fielding MSGS is likely to be much greater than the impact of fielding SINCGARS, the need for a smooth handoff of both systems becomes all the more crucial.

III. THE MATERIEL FIELDING PLAN

A. INTRODUCTION

This chapter is a descriptive presentation of the SINCGARS Materiel Fielding Plan (MFP). The intent is to place the SINCGARS project in the perspective of the framework and background of Chapter II, and to provide the reader with a sense of how the fielding process is intended to work.

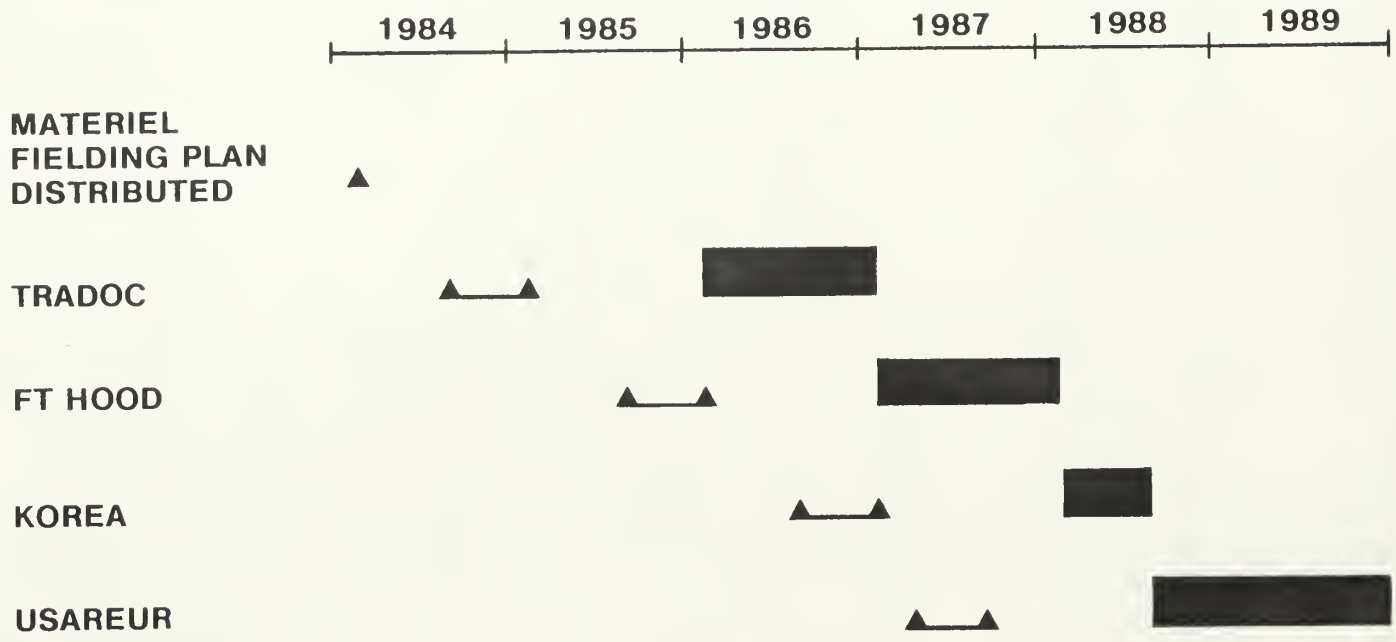
B. THE MATERIEL FIELDING PLAN

The Materiel Fielding Plan for the SINCGARS Ground Radio System was released in January 1983 and was revised on 29 February 1984 [Ref. 3]. It serves as the basis for the Materiel Fielding Subplan and the Materiel Fielding Agreement (MFA). negotiated with each Major Command (MACOM). The MFA is a document negotiated between the PM and each Major Command (MACOM)which enables the MACOM to have early input to the fielding process. The Materiel Fielding Plan describes the SINCGARS ground radio to be fielded, how it will be fielded, and the support required before, during, and after deployment. The plan represents a synthesis of efforts from each of the functional areas within the Army's Communications and Electronics Command. Within the SINCGARS Project Management Office there is a Materiel Division which has management responsibility for all matters pertaining to the materiel fielding effort.

The general fielding scenario calls for the fielding of the radios according to a priority listing of MACOMS. (See Table II) The fielding effort for each MACOM will be a three-phase effort as follows:

TABLE II

Fielding Schedule



SOURCE: SINCGARS Materiel Fielding Plan

1. Depot Staging

SINCGARS radios will be shipped from the contractor's plant to an Army depot for integration with associated end items. Some ancillary equipment will be sent to the depot, assembled with the major system equipment, and the remaining equipment assembled and crated for shipment with the radios under the total package fielding concept.

2. Pre-Handoff

Approximately 18 months prior to the handoff period, the Materiel Fielding Team (MFT) Leader will visit the gaining unit for a joint status review of handoff preparations and to coordinate actions required for the handoff phase. Additional visits will be made at twelve, six, and three months prior to handoff in order to insure continuous and timely materiel updates.

3. Handoff

During the handoff period, deprocessing, system checkout, materiel acceptance, and New Equipment Training (NET) will be accomplished. The handoff period begins with the arrival of the Materiel Fielding Team members and equipment and ends with materiel acceptance by the gaining unit commander.

During the initial fielding period, the Project Manager will provide the fielding teams with sufficient repair parts and operational floats to insure delivery of 100-percent operational radio systems to the gaining units. Initial provisioning of required Prescribed Load Lists/Authorized Stockage Lists (PLL/ASL) for support of unit and intermediate (Direct Support) maintenance will also be furnished to the gaining units during the handoff period. Repair/replacement of defective radio systems identified

during handoff, and prior to the gaining unit acceptance, will be accomplished by the Materiel Fielding Team with fielding team assets. Gaining unit acceptance will be on a radio installation basis and, once accepted, the gaining unit assumes total responsibility for maintenance of that radio installation.

Gaining units are responsible to insure that all required Test, Measurement, and Diagnostic Equipment (TMDE), as described in the Materiel Fielding Plan, is available at designated maintenance facilities prior to the beginning of handoff [Ref. 3: p. 3]. Gaining units are also responsible for the requisitioning of the memory hold batteries and the manpack batteries. Batteries will not be provided by the Materiel Fielding Team.

C. MATERIEL FIELDING AGREEMENT

As stated above, the MFP is the basis for the Materiel Fielding Agreement (MFA) which is negotiated with each MACOM. Specific responsibilities of both the MACOM and of the Office of the Project Manager are delineated in the agreement [Ref. 3: pp. 39, 46]. The Materiel Fielding Agreement represents an extremely important document in the whole acquisition process. Both parties commit themselves in the agreement to actions which represent the culmination of the entire program. The agreement specifically requires the MFT to install SINCGARS systems in every vehicle, and to conduct initialization and system checkout tests. Once this process begins, it is too late to discover that the gaining unit has had half of their M60 tanks replaced by M1 tanks. This would slow the fielding process, because the installation kit required for different vehicles are not the same. The earlier the MACOMs negotiate their Materiel Fielding Agreements, the more likely it is that their concerns will favorably affect design and fielding decisions.

D. DOCTRINE

The responsibility for development of Doctrine on how to deploy the SINCGARS radio rests with the Army's Training and Doctrine Command (TRADOC) [Ref. 7: p. 7.4]. Specifically, the TRADOC Systems Manager (TSM) is the focal point for this effort. While training and doctrine are not the subjects of this research effort, it is necessary to consider the effects of doctrine on the materiel fielding plan and logistical supportability.

A potential problem area stems from the dual capability of the SINCGARS radio to operate in either the frequency hopping mode or the single channel mode. If operated in the single channel mode, the SINCGARS radios can communicate with the present VRC-12 series and PRC-77 radios. When the SINCGARS radio is in the frequency hopping mode, communications with radios in the single channel mode is impossible. Since the transition from the old FM radios to SINCGARS will be occur over a period of years, it is clear that many situations will arise when Army units equipped with SINCGARS radios will have to communicate with units without SINCGARS. There is bound to be operational confusion whenever units are forced to change their communications mode to accommodate an interoperability requirement. The distribution plan for SINCGARS must therefore weigh operational considerations very carefully.

The issue can be stretched to serious extremes when one considers the hypothetical process of task organizing units on a theater or even global scale. The major restructuring associated with the Light Infantry Divisions and the New Manning System cloud the issue further. Two additional operational factors to consider are interoperability with allies and other Services, and frequency management.

Frequency management over a Theater Army area for frequency hopping radios is a whole new field. It is complicated by the fact that allied units will be operating within the same area using discrete frequencies. The questions of who has what type of radios and when will they transition has major implications in terms of supportability. A situation to be avoided is the case where a single unit has both types of radios on hand and therefore must keep spare parts for both radios.

The frequency management doctrine needed to effectively assign sets of frequencies, known as "hopsets", to minimize electromagnetic interference, and to maximize ECCM protection, has not been proven. This doctrine, embodied in a computer program which determines non-interfering hopsets, is currently being tested to the maximum extent possible with so few radios. A complete test of this doctrine will not occur until representative densities of radios are fielded in FY 87.

E. INITIAL OPERATIONAL CAPABILITY

The Initial Operational Capability (IOC) for SINCGARS is an ambiguous term because the radios will be fielded over a period of several years (See Table 1). As already mentioned, an orderly transition from old to new radios is of utmost importance. On top of the need for a smooth handoff, there is a pervasive pressure to "get SINCGARS fielded." The radios presently in use throughout the Army represent a 30 year-old technology which is highly susceptible to enemy jamming capabilities. Professional communicators are well aware of their vulnerabilities with the present equipment, and they want the capabilities which SINCGARS will bring [Ref. 16: p. 21].

The acceleration of the project in June 1977, by the Vice Chief of Staff of the Army, underscored the urgency for a radio with electronic counter-countermeasures (ECCM) capability. In addition to the ECCM capabilities, a growing need exists for radios with the capability to transmit data. The 9th Infantry Division, at Ft. Lewis, Washington serves as the Army's high technology "test bed", where numerous state-of-the-art technologies are "tried" in an operational environment. Because of the high density of equipment requiring data transmission capabilities, the 9th Division felt they could not wait for SINCGARS and procured a limited number of frequency hopping radios, manufactured by the Harris Corporation.

F. CURRENT STATUS

The decision to move SINCGARS into the production phase of the acquisition process was made at DSARC III in September 1983. However, as stated above, the production contract was not a multiyear contract because neither the production line nor the design had been stabilized. An additional DSARC review was conducted on 29 October 1984 to review design improvements made as a result of the maturity operational test conducted in July 1983 and to decide whether to exercise the first option. The results of the operational assessment conducted in September 1984 were positive, and consequently the October 1984 DSARC approved the exercise of the first year option to acquire an additional 3200 radios.

The Materiel Fielding Subplan for the Training and Doctrine Command (TRADOC) was released on 18 June 1984. Once the TRADOC schools have been issued SINCGARS, they will be able to train operators who will subsequently be assigned to field units throughout the Army prior to the arrival of

the radios. On-the-ground coordination between the Materiel Fielding Team (MFT) and the TRADOC schools has already begun and the first deliveries will proceed as scheduled in January 1986.

The introduction of the SINCGARS radio is an enormous undertaking. The radio is absolutely critical to successful command and control communications within the United States Army, and therefore, the fielding effort must be successful. The maintenance and supply support aspects of fielding present some potential pitfalls which can only be prevented through sound planning. Since fielding for SINCGARS is still over one year off, it is an opportune time to reexamine the planning for SINCGARS fielding.

IV. MAINTENANCE CONSIDERATIONS

A. INTRODUCTION

The operational deployment of the SINCGARS radio will be in the forward battle area. It will be the principal means of communications between units directly involved in ground combat. This fact places obvious constraints on the maintenance concept for SINCGARS, since the system must be capable of highly reliable operations, with operational availability exceeding most Army equipment. Perhaps of equal significance, is the requirement for a high degree of maintainability.

This Chapter will explore the SINCGARS Maintenance Concept with respect to broader defense guidance, and will identify some potential major problem areas which will will then be discussed. Possible resolutions to problem areas will be considered in Chapter VI.

B. MAINTENANCE CONCEPT

A comprehensive analysis of the SINCGARS maintenance concept requires a preliminary discussion of major trends in Army maintenance policies. Such a discussion flows naturally from the trend toward a "high tech battlefield".

The sophistication of military weapon systems has grown dramatically in recent years in conjunction with rapid advances in the electronics and data processing fields. Today's weapon systems reflect an ever-increasing level of technological sophistication. The growth in use of integrated circuit boards and micro-chip components has magnified the challenge of testing and repairing military hardware. In many cases, the skill level required to repair

components has far outstripped the Army's ability to perform extensive maintenance procedures with soldier labor [Ref. 4: p. 50].

This maintainability challenge has had a profound impact on the design process for weapon systems. Difficulty in performing detailed maintenance tasks directly conflicts with the Army's need to maintain a high state of operational readiness [Ref. 20]. This conflict can be reduced by design of weapon systems which are composed of Line Replaceable Units (LRU's) and Printed Circuit Boards (PCB's) which require minimal technical expertise to replace. Built in Test Equipment (BITE) is a common feature used to isolate faults to specific LRU's which can be easily replaced in order to restore the system to an operational condition [Ref. 8: p. 383]. These failed LRU's can then be transported back to some higher level maintenance organization where they can be repaired and returned to service as "floats" or shelf stock.

Alternative approaches for new systems range from designing "throwaway" LRU's to designing complex LRUs which require extensive technical expertise to repair. As the number of LRU's increases, the supply pipeline must be expanded to accommodate the increase [Ref. 20]. As the complexity of LRU's increase, the training requirements for maintenance personnel increase. Therefore, tradeoffs must be made to design components which are either repairable, or easily replaceable. If the design shifts toward replaceable components, they must be designed so that the quantity of inventory is manageable and affordable.

To a large extent, the maintainability parameters are driven by operational requirements. Many field commanders make forceful arguments that they cannot be bothered with repair problems in the forward battle area when they are engaged. in combat. At the same time, they cannot afford to carry a mountain of repair parts. Clearly, a huge

logistical tail is an undesirable characteristic.

Within CECOM, the decisions about what maintenance characteristics to design into a system are made with the aid of an Optimum Repair Level Analysis (ORLA). Through the use of an automated model called the Optimum Supply and Maintenance (OSAM) Program, decisions are made concerning what level of maintenance should repair or replace each LRU [Ref. 22].

C. LEVELS OF MAINTENANCE

The criticality of the SINCGARS radio for successful operations on the battlefield requires a highly streamlined maintenance system capable of providing rapid repair and return to the user [Ref. 16: p. 21]. The SINCGARS maintenance approach is based upon the Army's evolving concept of Unit, Intermediate (DS and GS), and Depot Maintenance [Ref. 14: p. 30]. Maintenance tasks, responsibilities, and actions to be taken at each echelon are as follows:

1. Unit Maintenance

The unit operator requires no test equipment to perform authorized maintenance at this level [Ref. 3: p. 22]. The maintenance functions are limited to cleaning, and checking for cracks, frayed cables and loose hardware. Using procedures in the operator's manual, the operator can determine if the radio system is functioning within specified performance limits. Operators are authorized to change the primary battery and the memory hold battery.

Unit maintenance will be performed by the Tactical Communications Systems Operator/Mechanic, MOS 31V, utilizing system built in test equipment, the AN/PRM-34 Test Set and the AN/PSM-45 Multimeter. Unit Maintenance will consist of fault isolation to LRUs. (ie., power amplifier, mounting adapter, power system, COMSEC equipment, antenna, audio

accessories, cables, mounting base) and removal and replacement of the faulty LRU. The faulty LRU will be returned to Intermediate
Direct Support level of
maintenance.

2. Intermediate Direct Support (DS)

The Field Radio Repairer, MOS 31E, will repair all faulty LRU's. Utilizing common test equipment and a SINCGARS Maintenance Kit (MK 2342/U), 31E personnel will fault isolate the LRU to the failed module (Shop replaceable Unit-SRU) [Ref. 3: p. 24]. The faulty SRU will be removed and evacuated to the Intermediate General Support evacuated to Intermediate GS for repair. (See Figure 4.1) LRUs and modules (SRUs) will be positioned at the Intermediate DS depending on the density supported and demand.

3. Intermediate General Support (GS)

Intermediate GS will perform the repair of SRUs (containing one to three printed wiring assemblies) by removal and replacement of faulty components and piece parts [Ref. 3: p. 26]. Fault isolation of the modules and printed wiring assemblies will be accomplished by the Electronic Repairer, MOS 35C, utilizing the Automatic Test Station AN/MSM-105 which includes the AN/USM-410 EQUATE and the AN/USM-465A Digital Card Tester. Once fault diagnosis of the Printed Wiring Assembly(s) has been accomplished, the defective PWA is identified and tagged. The module container with its defective PWA is sent to the Electronic Repair Facility (part of the AN/MSM 105) where the defective assemblies will be repaired by removal and replacement of piece parts. Once repaired, the SRU is returned to the test facility where it is again tested for Quality Assurance (QA) prior to being returned to DX stock. Additionally,

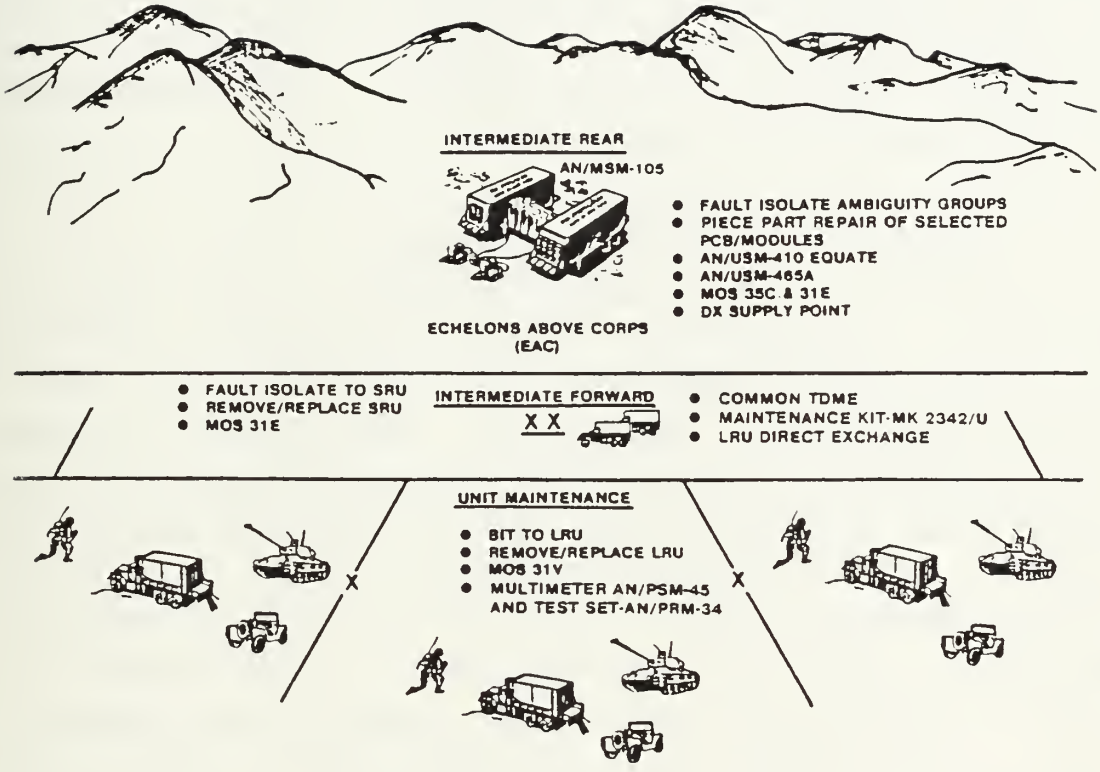


Figure 4.1 SINCGARS Maintenance Levels

traditional "mechanical type" repair functions will be performed at GS (ie., retap screw holes).

4. Depot Maintenance

Depot assignments for the SINCGARS are Tobyhanna Army Depot (TOAD) as the primary and Sacramento Army Depot (SAAD) as the secondary depot [Ref. 3: p. D2]. The depot will be responsible for repair of SINCGARS modules/PWAs when the required actions are beyond the capability of GS elements and for those modules which are maintenance coded for depot repair [Ref. 14: p. 33].

5. Contractor Maintenance

Contractor maintenance and supply support (GS level and depot) is required to support the initial fielding. This support will be required on a decreasing basis, for up to two years after IOC [Ref. 14: p. 35]. Plans are being established for GS and Depot Maintenance and supply from the contractor's facility at Ft. Wayne, Indiana during the initial fielding to TRADOC schools. During this period, unit and DS maintenance will be organic. The organic DS maintenance will be performed by the Directorate of Industrial Operations (DIO) at each school location. Support to the FORSCOM units will be organic at the unit and and DS level. GS and depot maintenance will be supplied by the contractor until organic GS and depot support are fully developed (FY88).

During the period of contractor support, procedures will be developed that will allow tracking of all modules returned for repair. This procedure mirrors the standard flow of defective modules to a depot facility and will allow early recording of failure data [Ref. 23].

D. WARRANTIES

Chapter II mentioned the new warranty legislation, which has had an interesting affect on SINCGARS. The initial production contract for SINCGARS ground radios was signed prior to the law taking affect. Consequently, the contract did not require a warranty from ITT. Three years of options were included in the contract, which means that no warranty will be required for the SINCGARS ground version for the first four years. However, the 29 October 1984 DSARC directed that the introduction of the second source be accelerated. The second source contract will be required to include warranty provisions and therefore by 1989 there will be two versions of SINCGARS ground radios in the field; one with a warranty and one without [Ref. 24]. This prospect has serious implications for the fielding effort.

Maintenance procedures at each level of maintenance are currently being drafted. Since there is no warranty on the current production contract, the maintenance guidance will assign specific repair responsibilities to maintenance personnel. Once the guidance is issued at the macro level in the form of technical manuals, the maintenance shops at all levels will devise standard operating procedures geared toward implementing the guidance.

When radios are fielded which carry a warranty, they cannot be handled in the same manner. An entirely new set of maintenance procedures will have to be drafted which prescribe what to do when a warranted radio enters the maintenance system. Under the warranty whole radios will have to be evacuated and treated "specially."

The radio systems in combat units are reportable items on unit readiness reports. Because of the adverse impact of a "down" radio in terms of operational readiness, it seems unlikely that field commanders will want to turn a radio in

to the maintenance system without an immediate replacement. Therefore, if a warranted radio is turned in to the maintenance system, a whole radio will have to be "floated" in order to keep the field unit combat ready. On the other hand, a radio without a warranty can be repaired by the army maintenance system. Faults will be isolated to an individual LRU and only the LRU will be replaced. The float of an LRU is quite different from the float of a whole radio. Having two systems is clearly cumbersome and conflicts with the guidance of DoD Directive 5000.1 as discussed in Chapter II above. By placing an additional burden on the already overburdened maintenance system, the dual warranty situation will not contribute to readiness or sustainability.

The contract for the airborne version of the radio is currently being negotiated, and it therefore will fall under the purview of the warranty legislation. The airborne version and ground version will consist of at least 80 per cent common parts [Ref. 23]. This should have obvious benefits in terms of maintenance and supply, but it is not at all clear what benefits will accrue to the Army.

It appears that the Army will not be able to take full advantage of the commonality during the airborne warranty period. Failed airborne radios will be returned to the contractor, while failed ground radios which are not under warranty will be repaired by soldiers.

E. AUTOMATED TEST/REPAIR FACILITIES

1. MSM/105 Automated Test/Repair Facility

The maintenance concept for the ground version of SINCGARS, as summarized above, is built around a heavy utilization of the MSM-105 automated test/repair facility. The current data on workload seem to indicate that sufficient MSM-105s will be fielded to accommodate all of the

potential SINCGARS radios. The only potential problem in this regard seems to be that the physical distribution of the MSM-105s may not be ideally suited for the corresponding distribution of SINCGARS. There are several cases where the TRADOC training posts are not co-located with an intermediate rear (IR) maintenance facility (where an MSM-105 is located). This problem will occur mainly at TRADOC schools, such as the Armor School at Ft. Knox [Ref. 25]. Consequently, some detailed planning will be required to delineate evacuation and direct exchange (DX) procedures for each specific location. This situation is not peculiar to SINCGARS, as several current and future weapon systems are designed for repair in an MSM-105.

2. Intermediate Forward Test Facility

The Army has recently decided to field an automated test facility at the Intermediate DS maintenance level. The Intermediate Forward Test Equipment (IFTE) will replace several smaller, specialized pieces of test equipment. IFTE is being designed to support several Army major systems, some of which are already fielded, and others soon to be fielded [Ref. 20].

IFTE is scheduled to enter the full scale development phase of the acquisition process in January 1985, with the first unit to be fielded in March 1989 [Ref. 20]. It seems clear that several IFTEs will be fielded either simultaneously, or shortly after SINCGARS fielding. It is not clear what affect the introduction of IFTE will have on the evolving maintenance concept for SINCGARS.

The MFP makes no mention of IFTE at all. Current guidance for Direct Support Maintenance is based on utilization of the DS test equipment specified in the MFP [Ref. 3: p. 43]. If IFTE is fielded on schedule, the maintenance procedures at the DS could be radically different. The DS

maintenance facilities will be required to utilize test program sets (TPSs) which have yet to be designed in conjunction with IFTE, and there will be no need for the ability to utilize the SINCGARS-peculiar test equipment, which is specified in the MFP.

F. IMBEDDED COMMUNICATIONS SECURITY EQUIPMENT

On 22 June 1984, Undersecretary of the Army Ambrose directed that the Communications Security (COMSEC) equipment for SINCGARS be imbedded into the frame of the radio as soon as possible [Ref. 23]. COMSEC equipment under the initial production contract is a separate LRU, independent of the SINCGARS unit. This decision represents a major shift in design which may require changes in the present maintenance doctrine. Since the National Security Agency (NSA) has overall authority over COMSEC equipment management, the maintenance and supply systems for COMSEC are wholly independent of the systems for all other Army equipment. The NSA management authority includes acquisition, distribution, maintenance and accountability for hardware and keying material. Inoperative COMSEC equipment is evacuated through a COMSEC maintenance system and is repaired by COMSEC repairmen.

At the direct support level, the COMSEC maintenance facility and the normal electronic maintenance shop are physically located in different locations. For units in Germany, the two maintenance facilities are often located on completely different installations and may even be in different cities. When a SINCGARS radio with imbedded COMSEC is turned in to the DS maintenance shop as inoperative, it is not clear what the procedure will be to troubleshoot and repair the system. A Radio Repairer (31E) does not have the requisite training, much less the authority, to perform maintenance on COMSEC equipment.

The decision to combine the SINCGARS radio with its associated COMSEC is intended to simplify the user's job. The user's job may indeed be simplified if the integration is well-executed. However, significant attention in this area will be required to preclude problems.

The COMSEC integration will be performed in CY 89 as a Preplanned Product Improvement (P I), as it is now planned. Prior to that time, a number of significant issues must be resolved. A determination must be made as to responsibility and authority for maintenance of a radio with COMSEC components inside. Otherwise, confusion over who may perform maintenance on what parts of the radio may develop.

The effect of the COMSEC modification must be accounted for in the Test Program Sets (TPSs) for both the MSM-105, and the IFTE. The TPS for a COMSEC-equipped SINCGARS radio will be different than the TPS for a radio without COMSEC. Since a major portion (over 40,000) of radios will be fielded prior to the COMSEC modification, it will be necessary to maintain TPSs for radios with and without COMSEC. Similarly, it will be necessary to maintain separate and distinct repair procedures.

Because of the COMSEC modification there is a potential for problems with respect to the distribution plan for SINCGARS radios. If a single unit receives radios with COMSEC imbedded in addition to radios without, the unit must maintain the capability to repair both versions of the radio. The maintenance capability must include spare parts, training, and Test Program Sets. This duplication of maintenance effort is inherently counterproductive, and it impedes the maintainability objectives expressed in DoD Directive 5000.39 [Ref. 26].

G. SUMMARY

The legislation to require warranties, and the decision to imbed COMSEC will cause major revisions to the evolving SINCGARS maintenance concept. Although these changes were made subsequent to the initial planning for the project, the PM must accommodate them as smoothly as possible. The PM staff is well aware of the challenges in these areas and the current planning is geared toward meeting the challenges.

V. SUPPLY SUPPORT CONSIDERATIONS

A. INTRODUCTION

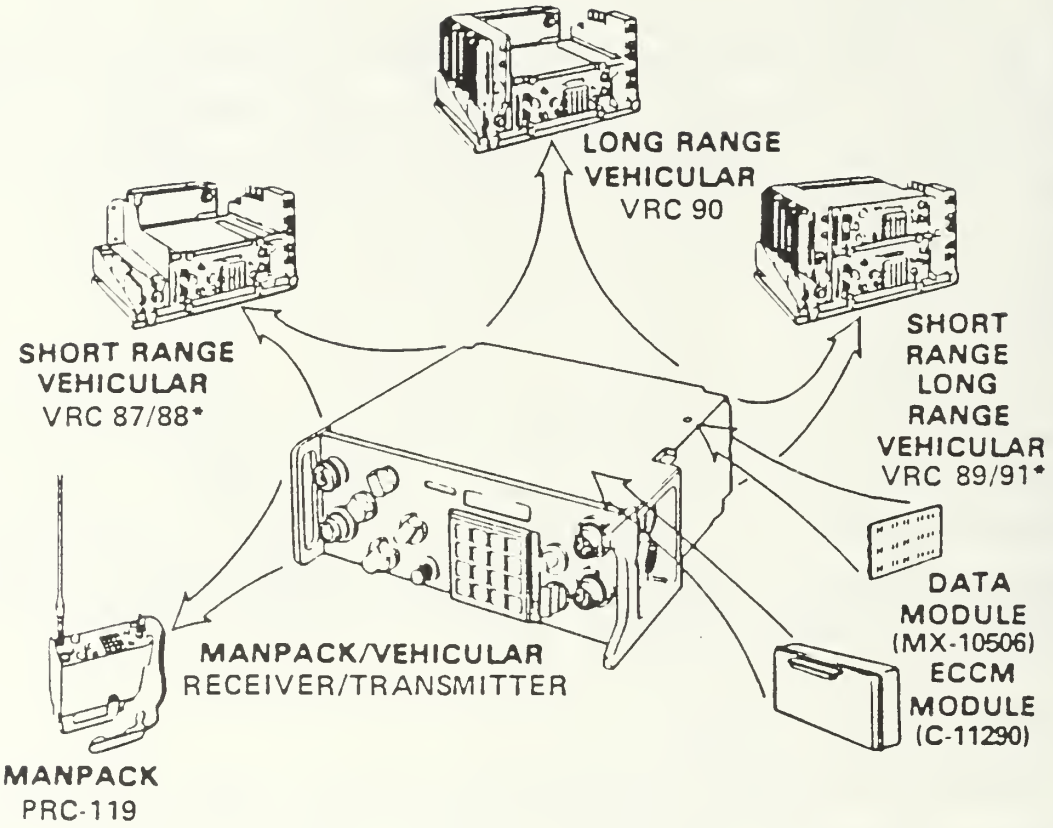
The SINCGARS radio will be organic to nearly every unit in the Army. Since none of the individual components of the VRC-12 series or the PRC-77 radios are interchangeable with SINCGARS, the introduction of SINCGARS radios will require a complete transition of the repair parts. This includes the installation kits for mounting the units, antennas, and cables.

This chapter will analyze the supply support planning associated with the SINCGARS fielding effort and will examine potential problem areas. Supply support for the SINCGARS project is summarized in detail in the Integrated Logistics Support Plan for SINCGARS Ground Radio Systems, released 15 March 1984 [Ref. 14].

B. THE SINCGARS RADIO

SINCGARS has been designed on a modular basis to achieve maximum commonality among the various system configurations. For example, a common receiver-transmitter (RT) is used in the manpack and all vehicular configurations [Ref. 14: p. 3]. There are a total of ten components which make up the various SINCGARS configurations. (See figure 5.1)

Since the SINCGARS radios will be phased-in over a period of ten years, the transition of repair parts flow will be an evolving process. As the demand for SINCGARS parts increases, the VRC-12 and PRC-77 spare parts demand should decrease. The recommended VRC-12 series radio prescribed load list (PLL) stockage for a combat battalion represents roughly $10,000 in inventory costs [Ref. 37: p.



*Includes a Dismount Capability

Source: SINCGARS Integrated Logistic Support Plan

Figure 5.1 SINCGARS Configurations

16]. This means that at least $3 million worth of spare parts is stocked at the lowest inventory level on an Army-wide basis at present. In view of the potentially high total dollar value of the inventory for both types of radios, sound planning can clearly preclude wasteful investments in inventory which will not contribute to operational readiness.

C. PROVISIONING

The reliability and maintainability characteristics of SINCGARS are, of course, design parameters. The actual values for components will undoubtedly vary somewhat from the design figures. Even though the associated failure data cannot be predicted very accurately, methodology exists for deciding how many of each type of spare parts to include in the original provisioning package. Within CECOM, two models are used for automatically computing initial issue quantities (IIQ) based on assumed order-ship times, operating level, and safety level quantities. The Selected Essential-Item Stockage for Availability Method (SESAME) model is used when no historical maintenance data is available, and the Automated Requirements Computation Initial Provisioning (ARCIP) model is used when a sufficient degree of data is built up.

Initial provisioning for SINCGARS will be accomplished under the total package fielding concept [Ref. 3: p. 43]. Under this concept, all major end items, installation kits, PLL and ASL, will be pre-staged at a depot prior to shipment. They will be shipped during the hand-off phase and will remain under control of the materiel fielding team until accepted by the gaining command.

The provisioning for SINCGARS will be built up slowly. Because of the high degree of contractor support initially,

there is no need to procure a large number of spare parts. As the failure data are accumulated by the contractor maintenance system, it will be possible to input these data into the ARCIP model, and receive meaningful provisioning objectives. This approach is consistent with DoD guidance. DoD Directive 5000.39 states the following:

> When determined necessary, interim contractor support shall be planned to avoid compressing support delivery schedules...Transition to government support normally shall be scheduled to occur after the system design is stable, the capability to support the system has been demonstrated, and the planned ILS resources for the mature system can be delivered. [Ref. 26]

The system design is expected to become stable after the production is well underway and after failure data have been accumulated. As the production rate of the radios is increased, spare parts provisioning will grow in turn.

D. DISPOSITION OF OLD RADIOS

The SINCGARS radios will replace the older VRC-12 family and PRC-77 on a one-for-one basis. This means that over 171,000 "old" radios will be displaced. The current value of the inventory of old radios on hand is nearly $ 600 million.* The prospect of turning-in, and redistributing 171,000 radios has some potentially serious hazards.

The current planning for the turn-in and redistribution of old radios is in the early stages and will require much further development. The guidance issued by DA calls for redistribution according to the following priorities: [Ref. 27]

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* If the current inventory of radio sets on hand is multiplied by the prices on the Army Master Data File (AMDF), the value of all radio sets, less installation kits, is over $550 million [Ref. 33].

1. Interchange requirements for force modernization equipment.
2. Redistribution within the MACOMs' active components.
3. Redistribution within the MACOMs' reserve components.
4. Foreign Military Sales.
5. Grant aid.

At the present time, it is not clear how many (or when) radios will be transferred to each of the these priorities. Since disposal is not listed as one of the priorities, it is assumed that a need exists for each old radio. This is a critical assumption because it bears on how much effort should be expended in planning for redistribution.

Since all of the radios will be redistributed somewhere, it can also be assumed that all of them must be in a fully operational condition. Sizeable funds may be needed to place the old radios in transferable condition.

In order to transfer a piece of equipment from one hand-receipt holder to another, it must meet "10/20 standards" [Ref. 38]. This simply means that all maintenance requirements at the operator and direct support levels (10 and 20 level) must be fulfilled, and a radio system which merely transmits and receives does not necessarily meet these conditions. A recent maintenance "peak up" of radios in the 82nd Airborne Division provides some insight into the true condition of present radios. The 82nd is considered by many to be one of the most combat ready units in the Army, yet the results of this inspection indicate serious deficiencies in the operational condition of the equipment on hand.

The Logistics Assistance Team (LAT) assisted the 782nd Maintenance Battalion personnel in testing 58 systems installed in vehicles and 74 backpack systems from 28 July to 1 August 1980. The vehicular configurations were 87% Non-Operationally Ready (NOR) and the backpack systems were

35 percent NOR [Ref. 28: p. 2]. To extrapolate the 82nd experience into an Army-wide estimate would be inaccurate for planning purposes. However, some similar data is available for units of the 7th Infantry Division at Fort Ord, California. During a 1982 program to upgrade the condition of the division's radio systems, $82,541.50 was spent on parts to repair installation kits alone [Ref. 29]. If this figure were reflective of conditions throughout the Army, the cost of bringing all installation kits up to 10/20 standards would be over $2 million.

Further evidence of an Army-wide problem concerning the operational condition of VRC-12 series radios can be found in a "Lessons Learned" report from the Commanding General of the United States Army Signal Center and School, Ft. Gordon, Georgia. The report refers to a January 1980 test of radios in the Army's 1st Armored Division in Germany:

> It also was found from the January 1980 test that there was the gross lack of preventative maintenance by the operators and crew members. It was evident from the test results that the crew members of combat vehicles were not properly installing or caring for their radio systems. It was found that equipment is used until it does not work any longer and then it is removed for repair, either by the 31V10 or a repairer at direct support. Numerous instances of broken or corroded connectors, poor installation, and improper operation were observed. [Ref. 37: p. 6]

When user units are approaching a handoff date for SINCGARS, they may decide not to requisition sufficient spare parts in time to bring their old radios up to speed. If they order enough parts, they may exhaust the supply system. Either way, they will be jeopardizing the SINCGARS handoff date and since spare parts are stock funded, the budgetary process may be unable to cope with the spurt in requirements.

An alternative to letting the system take its course would be to turn in all radios to a depot and perform

overhauls of selected radios. This is the type of procedure which would be necessary if it were discovered that many of the old radios were in sufficiently poor shape as to need a total rebuild. There is some data available on this procedure, as it has been performed for several years, and the Materiel Management Directorate at CECOM budgets for a limited number of depot rebuilds each year. The average cost for a rebuild for the RT-524, which represents the radio-telephone component of most VRC-12 configurations, is over $1800 per radio [Ref. 34]. The cost for overhaul of PRC-77 family radio-telephones is over $1000 per radio [Ref. 34].

Finally, the redistribution of old radios is not a "sexy" topic. It is easy to see why personnel involved in the fielding for SINCGARS would not be interested in this area. However, the impact of a poor transfer could be tremendous. Field commanders cannot afford to be without communications. If fielding SINCGARS to a unit becomes contingent upon the unit successfully transferring their old radios, the SINCGARS fielding could be held up. If units attempt to transfer old radios which are not in 10/20 standards, and the new owners refuse to accept them, the transfer process could come to a detrimental halt. In this respect, the Project Manager for SINCGARS is effectively the Project Manager for the redistribution of the VRC-12 series and PRC-77 radios.

E. TEST EQUIPMENT AT DIRECT SUPPORT

In Chapter IV, we discussed the introduction of the intermediate Forward Test Equipment (IFTE) as it applies to maintenance considerations. The IFTE fielding may have some significant supply support considerations, as well. The maintenance concept for SINCGARS was conceived without

consideration for IFTE [Ref. 14]. The MFP makes no reference to IFTE [Ref. 3]. However, it seems that the IFTE will be fielded very close behind SINCGARS, and it will replace all pf the DS-level TMDE specified in the SINCGARS MFP.

The SINCGARS MFP requires the following TMDE at the Intermediate Forward (DS) level:

1.	Oscilloscope	AN/USM-488
2.	Function Generator	SG-1171/U
3.	Counter	TD-1225A(V)2
4.	Digital Voltmeter	AN/USM-486
5.	Distortion Analyzer	AN/URM-184A
6.	Signal Generator	SG-1112(V)1/U
7.	Maintenance Kit	MK-2342/U

Each of these items of equipment are already on-hand in Army units, except the oscilloscope and the digital voltmeter. If IFTE is fielded on time, it is possible that some units will never need these two pieces of SINCGARS-peculiar TMDE. Approximately $150,000 in procurement money would be required to equip every DS unit in the Army with both the oscilloscope and the digital voltmeter.* The current planning calls for a procurement of sufficient quantities to support fielding of SINCGARS up through Korea, at a cost of approximately $60,000. If IFTE is fielded on time, there will be no need to procure additional oscilloscopes and voltmeters to support fielding to USAREUR and FORSCOM, because they will never get to use the equipment. (See figure 5.2) This means that $90,000 could be saved if IFTE is fielded early enough to support SINCGARS.

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* The oscilloscopes cost $830/each and the digital voltmeters cost $408/each. There are 128 DS units which would require them.

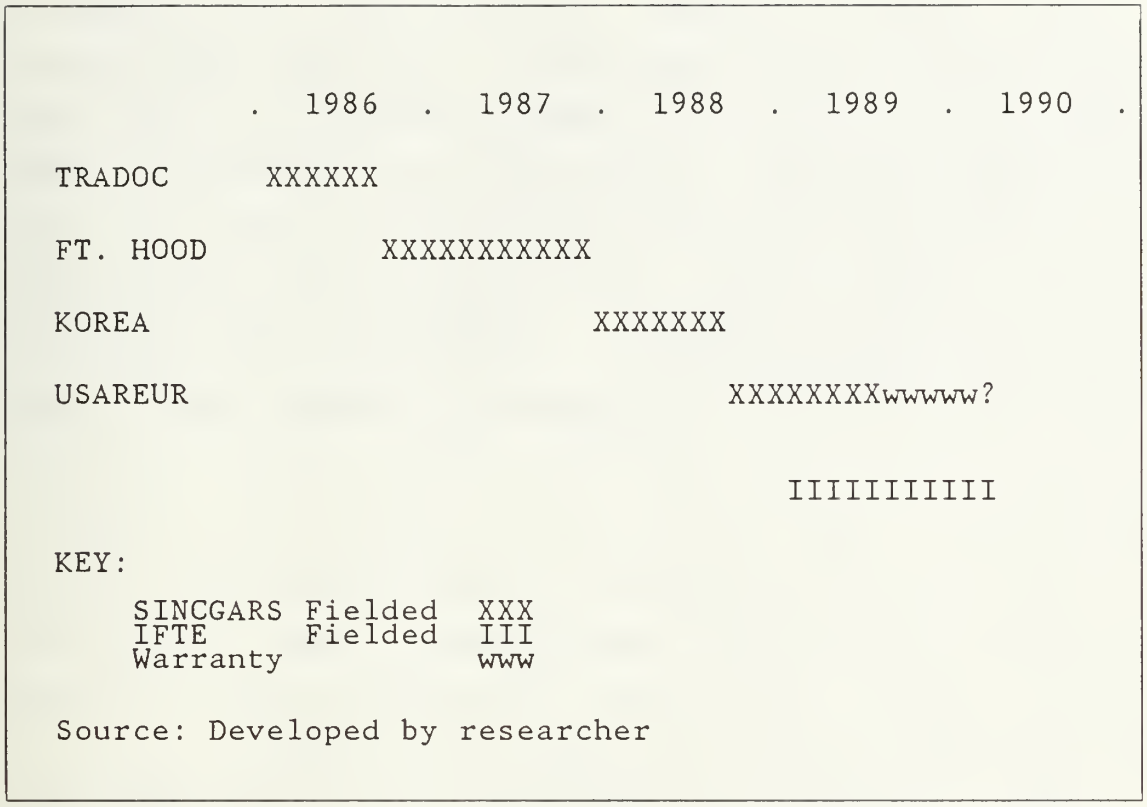

Figure 5.2 IFTE/SINCGARS Fielding

F. OLD INSTALLATION KITS

There are presently more than 600 different types of installation kits for the old VRC-12 series and PRC-77 radios. Installation kits are necessary to adapt the radio-telephone equipment to over 40 different types of vehicles in the Army inventory [Ref. 3: p. H2]. The basic components of a typical installation kit include antennas, speakers, cables, mounting bases, mounting hardware, handsets, and other associated items required for operation. The installation kit used for the installation of a VRC-46 radio system in a jeep is enclosed at Appendix B. A brief perusal of the component listing reveals the fact that the kit consists of large numbers of small expendable piece parts.

The various SINCGARS configurations will require completely new installation kits. The only thing common between the two is the fact that the new kit will have the same "footprint" and mounting holes as the MT-1029 mount used with the VRC-12 family of radios [Ref. 14: p. 7].

As the old radios are transferred from one unit to another, the requirement for an associated installation kit will be transferred as well. A significant portion of the "old" installation kits will not be re-usable. Most of the hardware used to fasten the major parts to vehicles has been subjected to years of rust, and several coats of paint. Additionally, many pieces will be damaged during removal. Virtually all of the components of installation kits hold an expendable accountability classification code. Therefore, there is little incentive for the present owners to worry about how much of their old kits can be re-used.

There is currently a shortage of over 15,000 installation kits of the old type [Ref. 35]. When large quantities of installation kits are laterally transferred, there will be a corresponding surge in the demand for most of the components of installation kits. There is a potential for the supply and budgeting systems to be unable to accommodate this surge.

This research effort has not uncovered any planning effort within CECOM which addresses the possibility of shortages of installation kits or components of installation kits following redistribution. Given the fact that the operational condition of installation kits is known to be less that 10/20 standards (See Section B above), and given the assumption that a need exists for all present installation kits, the need for a plan in this area seems clear.

G. SUMMARY

The redistribution of old radios and installation kits looms as the greatest potential hazard to the SINCGARS fielding effort. The responsibility to plan for the redistribution cannot be ignored because a major problem in the redistribution effort can have a direct impact on the fielding effort for SINCGARS. Therefore, the fate of the old radio system is very much a part of the SINCGARS project and must be dealt with accordingly.

VI. MATERIEL FIELDING: SOLUTIONS TO ISSUES AND PROBLEMS

A. INTRODUCTION

This chapter will present potential courses of action which may avert or alleviate problem areas identified in Chapters IV and V. The solutions are structured within the context of the framework discussed in Chapter II. Each solution is intended to reduce the potential for large resource requirements which might result from failure to address the issues.

B. REDISTRIBUTION OF OLD RADIOS

The distribution requirement for VRC-12 series and PRC-77 radios which will exist following the complete fielding of SINCGARS must be crystalized. The redistribution guidance, as it currently stands, appears to imply that a need exists for every VRC-12 series and every PRC-77 radio. If this indeed is the case, the specific requirements must be set down in detail in order to facilitate planning.

If there is a bona fide requirement for all of the old radios, the question of how to best facilitate the transfers must be broached. Either all of the radios should be turned in to a depot for reconditioning or overhaul or a means of ensuring a uniform quality standard should be devised for a decentralized approach. The latter course of action seems difficult at best. Based on the data discussed in Chapter V, the magnitude of the problem may be quite large. Many parts will be required and they will have to come through a demand-supported system which will be slow in responding to a massive upgrade of the caliber necessary.

The quality of the initially redistributed radios will be inconsistent and poor, since it is likely that units will offer up their lesser quality radios and keep their best. Many radios will be redistributed within Major Commands (MACOMs). Clearly, any redistribution of this nature is the responsibility of the particular MACOM concerned. If for instance, Forces Command (FORSCOM) units attempt to transfer subquality radio systems to other FORSCOM units, the PM SINCGARS can have little input to the transaction. It is the FORSCOM Commander's responsibility to ensure that his radios meet 10/20 standards.

For transfers between MACOMs the problem is more complex. If the decision is made to make transfers without a centralized turn-in, there must be some provisions made to make this process flow smoothly. Field commanders must be made aware of the fact that their equipment does not currently meet 10/20 standards and they must be made aware of what the minimum standards for transfer will be. Finally, time and money must be budgeted to enable field commanders to bring their equipment up to the specified standards prior to the hand-off date.

It appears to this author that the most effective method of redistributing old radios is a centrally managed approach. All radios which must be transferred between MACOMs would be brought to a depot maintenance facility. Radios could be screened efficiently for overhaul, and repair parts could be ordered efficiently. A uniform quality control standard could be possible and detailed accurate status reports could be obtained rapidly.

C. INSTALLATION KITS

The challenges regarding redistribution of installation kits closely parallel the issues concerning the

redistribution of radios. Only a centralized plan can be effectively and consistently implemented. The detailed plan for the redistribution of radios should also specify how many of each type of installation kit are required at each specific destination. Installation kits which pass through a depot maintenance facility can be inspected, and fully overhauled, if necessary. A forecast of potential installation kit rebuilds could be made along with an estimate of how many specific piece parts will be required. This will allow the procurement system to anticipate long lead time items and to take advantage of economic order quantities.

D. IMBEDDED COMSEC

The modification which will imbed COMSEC into the frame of the radio is presently under development. It is crucial that the engineering process take into consideration the potential problem areas identified in Chapter V. The major hurdle for the imbedded version of SINCGARS is the distinction which exists between the COMSEC maintenance system of NSA and the conventional electronic repair facilities of the Army. Unless the modified version is designed to fit into the two current systems, there will have to be some effort made to marry the two systems. One method of integrating the two systems is to assign COMSEC repairmen (31S) into the conventional DS maintenance facilities. This way, a COMSEC-modified radio would not have to be physically transferred between maintenance facilities depending upon whether it has a COMSEC problem or a conventional repair problem.

Further integration could be achieved by physically combining the two shops. This solution has some significant drawbacks. First, it would involve a great deal of coordination with NSA. There is some doubt whether they would be willing to relinquish authority over any COMSEC activities.

The second problem involves the nature of the two facilities. The SINCGARS radio is not the only COMSEC equipment which must be repaired by the COMSEC maintenance personnel. It does not make good sense to combine COMSEC maintenance facilities with conventional electronics maintenance facilities because of a single type of equipment.

Another approach to the COMSEC modification would be to design the COMSEC module to be easily removed from the frame of the radio. This approach would favor a COMSEC module which functions in the same manner as the current COMSEC equipment. The module would simply be located inside the radio. In this situation, an inoperative radio system might be diagnosed to the point where it is determined that either the radio is defective or the COMSEC module is defective. If the COMSEC module is defective, it can be removed and sent to the COMSEC repair facility. This way, the two maintenance facilities could maintain their integrity and adequate security could be preserved.

The COMSEC modification will obviously require at least some changes to the operation and maintenance procedures for the SINCGARS radio. If possible, the Test Program Sets for a radio with imbedded COMSEC should be identical to the TPS for a radio without the modification. Differences in parts and operation should be kept to a bare minimum.

If there are differences between the two versions, the impact of these differences can be minimized through a thorough distribution plan. The fielding schedule is known in advance and the production schedule is known in advance. The production lots should be matched with gaining commands in a way which precludes a gaining unit from receiving two "flavors" of radio. If a MACOM has to receive both flavors of radio, at least the distribution to the subordinate units should be consistent.

E. WARRANTIES

It is almost certain that both the airborne version of SINCGARS and the second source ground version will have warranties while the current ground radio does not carry a warranty [Ref. 24]. It will be necessary to either plan for this situation to minimize the difficulties or to procure a warranty for all of the radios. In order to minimize difficulties, there will need to be some means of clearly identifying a radio with a warranty from one without. Some type of seal on the radio case is a suitable method [Ref. 36].

Even with a means of identifying radios, it will be difficult to manage the two types of radios separately. Maintenance plans will have to delineate procedures for evacuating radios having a warranty and for repairing a radio without a warranty. The contractor will be heavily involved in the maintenance of the first 40,000 radios. Therefore, a better solution to the warranty problem would be to obtain an express warranty for radios produced under the initial production contract. The increase in compensation which the contractor is likely to demand will be offset to some degree by the avoidance of confusion and complexity in the maintenance management area. A tradeoff of this type is consistent with the policy and guidance in Chapter II.

F. DIRECT SUPPORT TEST EQUIPMENT

The possibility of procuring unnecessary direct support test equipment because of the fielding of the Intermediate Forward Test Facility represents a relatively small dollar figure. In order to prevent such a situation, there must be some coordination between the SINCGARS staff and the Test Equipment Modernization (TEMOD) staff. The decision to procure the additional digital voltmeters and oscilloscopes

can be delayed up until the required lead time to buy the equipment. By that time, the fielding schedule for IFTE will hopefully be solidified.

VII. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

1. What are the major potential problem areas in the system support area of the Materiel Fielding Plan for the SINCGARS ground radio system, and how might these problems be addressed?

   The major problem areas, as addressed above in the conclusions and recommendations, are the redistribution plan for old radios and installation kits, the imbedded COMSEC modification, and the lack of warranty on the current production contract. The magnitude of the problem regarding procurement of unnecessary D.S. test equipment is relatively small in relationship to the entire SINCGARS project.

2. What are the principal characteristics of the Materiel Fielding Plan for the SINCGARS ground radio system?

   The ground radio MFP calls for "handoff" of 100% operational radio systems which will be installed by the MFT into the user vehicles. The SINCGARS radios will displace the VRC-12 and PRC-77 radios on a "one-for-one" basis and all of the radios will be redistributed to other units or countries.

3. What is the maintenance concept for SINCGARS, and how can it be implemented?

   The SINCGARS radio is designed to be repaired within the Army's standard three-level maintenance system. The radio has a modular design and built in test

equipment to facilitate isolation to line-replaceable units. The AN/MSM-105 Automated Test/Repair Facility will be utilized at GS and Depot Maintenance for test and repair of SINCGARS shop-replaceable-units (SRUs). The initial fielding will be supported by contractor maintenance and supply at GS and Depot maintenance levels.

4. What are the warranty/guaranty features and how will these be enforced?

   The initial ground version production contract does not include a warranty. The second source ground version, as well as the airborne version will be required to have a warranty provision. There is no detailed planning concerning the enforcement of the warranties because they have yet to be contracted for. However, this research shows that having a warranty for equipment in a combat unit presents administration problems in terms of field repair. If there are identical radios, some with warranties, and some without, the administration problems may be still more difficult.

5. What are the key aspects of supply support for SINCGARS, and what are the implications in terms of spare parts acquisition?

   The spare parts for SINCGARS will ultimately be procured as a result of a demand-driven supply system. However, the initial provisioning will be effected with the assistance of the Selected Essential-Item Stockage for Availability Method (SESAME) model. Since supply support will be augmented by contractor support for the initial fielding, spare parts procurement will not be made on

a large scale until adequate failure data has been developed.

6. What resource requirements have yet to be identified?

   The funding for the repair of the old radios will require additional resources which have not yet been budgeted. In addition to the repair of old radios, the repair/replacement of old installation kits will require further funding.

7. How might the problems identified in the maintenance and supply support planning be addressed and resolved?

   Each of the problem areas identified, are being addressed to some degree already. The redistribution of old radios appears to require the most additional attention. If CECOM were to develop an accurate estimate of the true condition of old radios and installation kits, they could budget funds and then order parts in an efficient manner. Responsibility for the drafting of a Materiel Transfer Plan should be identified and a centrally controlled transfer plan should be implemented.

B. CONCLUSIONS

The SINCGARS project is one of the largest in the Army and the success of the program is crucial to the Army's combat effectiveness. The Project Manager staff is a highly capable organization which is well aware of the issues identified in this study. The Materiel Fielding effort has been several years in development and reflects the lessons learned in earlier programs. Notwithstanding the acceleration of production in 1977, the SINCGARS project has been underway nearly ten years.

The quality of the MFP is obvious and it reflects the lengthy maturation period the program has enjoyed. While this study has identified some potential problem areas regarding the MFP, none of these appear to be unmanageable or undetected by the program office.

The following conclusions are supported by this research effort:

1. Without significant development of the planning for redistribution of the VRC-12 series and PRC-77 radios there may be problems in this area. As discussed in Chapter V, Section D, this conclusion is based on the assumption that a need exists for each old radio, and the assumption that a significant quantity of old radios will require additional resources in order to effect a smooth transition. Combat units will not accept equipment that is of poor quality and, without a centralized redistribution plan, some units may attempt to transfer some of their old radios in less than 10/20 standards. Effective transfer of the old radios will affect the fielding of SINCGARS, so the significance of the redistribution effort should not be ignored.
2. The potential for problems in redistributing the radios will be matched by similar problems redistributing installation kits unless the planning in this area is improved. An installation kit is as important to the operational deployment of a radio system as the radiotelephone itself. Based on the limited data available, it appears that the condition of a majority of the installation kits is generally less than the 10/20 standards (Chapter V, Section D). Redistribution without a rebuild program may be infeasible. Installation kit components which require long lead times to procure may impede the

transfer process if the parts shortages are not forecasted early enough.

3. The fact that the airborne version and the second source ground version will be warranted while the present ground version is not may cause problems within the Army maintenance system. There may be confusion over which radio has a warranty and which one doesn't. It will be difficult to manage the two different types because the radios which are warranted will presumably carry restrictions on the exercise of the warranty. Maintenance personnel who have worked on unwarranted SINCGARS radios and come across a warranted version may inadvertently "fix" a radio that they should not. Maintenance managers will have to devise procedures to prevent this type of situation. More importantly, they will have to devise a dual set of maintenance procedures for the two versions of radio even though they are essentially the same.

4. The imbedded COMSEC modification may cause significant problems in terms of the SINCGARS maintenance concept. The greatest potential problem area centers around the maintenance procedures and equipment. The COMSEC maintenance and direct support electronic maintenance shops are presently wholly independent of each other. It is not clear what procedures will be used for repairing a radio which has COMSEC imbedded. If the version with COMSEC differs greatly from the version without, there may be a need for a parallel set of test program sets, parallel maintenance manuals, and parallel spare part flows. As with the warranty issue this will place an added burden on the maintenance manager.

5. If the Intermediate Forward Test Equipment (IFTE) is fielded to the United States Army Europe (USAREUR) prior to CY 1990, there will be no need to procure $90,000 worth of direct support test equipment. The Materiel Fielding Plan calls for the procurement of two items of SINCGARS-peculiar test equipment. IFTE will supercede the need for both items of equipment, and IFTE is scheduled to be fielded in March 1989 (Chapter V, Section E). However, if IFTE is not fielded prior to 1990, the equipment will have to be procured since it is necessary to perform the DS maintenance function.

C. RECOMMENDATIONS

The following recommendations are a result of this research effort:

1. Develop a detailed plan for the centrally controlled redistribution of VRC-12 series and PRC-77 radios. Effective transfer will require additional funds which have yet to be budgeted. An estimate of repair costs should be made and a plan should be drafted for a centrally controlled redistribution process. The plan should direct that all radios redistributed from one MACOM to another be directed to a depot. The depot should screen candidates for complete overhaul versus minor repairs and repair parts should be ordered centrally.
2. Redistribution of old installation kits should be centrally managed in a manner similar to the radios. The current condition of installation kits is similar to that of the radios. In order to effect a smooth transfer, there will have to be both a reconditioning of major components of installation kits and procurement of large quantities of minor kit

components.

3. Consideration should be given to the procurement of a warranty for the present ground version of SINCGARS. It would be difficult to calculate a dollar figure for the savings to be enjoyed by this course of action. However, such a move would clearly eliminate the possibility for confusion in field units. Since ITT will be deeply involved in the maintenance process for the first two years, it could be argued that the Government has already purchased a warranty of sorts.

4. The engineering process for the imbedded COMSEC modification should be tightly controlled. The engineers should be constrained in the design of the imbedded COMSEC version of SINCGARS so that the new version does not require a whole different maintenance process. The change should be as "transparent" as possible for the user in terms of maintenance and operations. Ideally, the imbedded version of SINCGARS will require no changes to the maintenance process.

5. The fielding schedule for the Intermediate Forward Test Equipment (IFTE) should be finalized as soon as possible. If IFTE will be available in USAREUR prior to 1990, the MFP directive to procure DS level TMDE should be modified. The oscilloscope, AN/USM-488, and the digital voltmeter, AN/USM-486, should not be bought for USAREUR and FORSCOM if they will never use the equipment. According to the current schedule for IFTE fielding, it appears that IFTE will, in fact, arrive in USAREUR and FORSCOM units ahead of SINCGARS.

D. ADDITIONAL AREAS FOR RESEARCH

This study has been restricted to the maintenance and supply support aspects of the SINCGARS Materiel Fielding Plan. However, during the course of the study two areas which might benefit from additional research were identified.

Many of the more significant problems encountered by the SINCGARS program have been caused, to some degree, by the acceleration of the program in 1977. During the ensuing concurrency the Program office had to play "catch up" in several areas in order to prepare for the transition to production. When the decision to accelerate the program was made, it was not known in any detail what the hidden costs of the acceleration might be. A cost/benefit analysis of the concurrency experiences of SINCGARS would be extremely helpful to other decision makers considering concurrency for other systems.

Similarly, the decision to imbed COMSEC has had, and will continue to have, many hidden costs. While there is a notion that a major change to a project will have spillover costs, an analysis of those costs in a specific case could provide data which will improve the decision-making process for future changes.

APPENDIX A
LIST OF INTERVIEWS

1. Baldwin, Edward R., COL., Project Manager SINCGARS, Ft. Monmouth, N.J., 27 March 1984 and 11 July 1984 (Personal).

2. Spalding, Kathy, Provisioning, Directorate for Materiel Management, CECOM, Ft. Monmouth, N.J., 13 July 1984 (Personal).

3. McGowan, Mike, Electronics Engineer, Directorate For Force Modernization and Integrated Logistics Support, CECOM, Ft. Monmouth, N.J. 10 July 1984 and 11 July 1984 (Personal).

4. McFarlane, Maureen, Deputy Project Manager SINCGARS, Ft. Monmouth, N.J. 27 March 1984, 9 July 1984, 10 September 1984, and 1 November 1984 (Personal).

5. Mundry, Tom, MAJ., Chief Logistics Management Division, SINCGARS, Ft. Monmouth, N.J. 13 July 1984, 10-14 September 1984, and 2 November 1984 (Personal).

6. Olson, Walter, LTC., Chief, Materiel Fielding Division, SINCGARS, Ft. Monmouth, N.J. 27-29 March, 12 July 1984, 10-14 September 1984, 10 October 1984, 1 November 1984 (Personal), and 29 August 1984 (Telephone).

7. Grivieas, George, MAJ., Communications and Electronics Branch, Deputy Chief of Staff for Logistics, Department of Army, The Pentagon, 14 August 1984 (Telephone), and 12 September 1984 (Personal).

8. Nash, John, MAJ., Program Manager's Office for Automatic Test Support Systems, Office of the Project Manager, Test, Measurement, and Diagnostic Equipment, Ft. Monmouth, N.J.,

20 August 1984, (Telephone), and 14 September 1984 (Personal).

9. Perrapato, John, Chief, Technical Management Division, SINCGARS, Ft. Monmouth, N.J., 28 March 1984, (Personal).

10. Myslinski, Joe, Chief, Program Management Division, SINCGARS, Ft. Monmouth, N.J., 28 March 1984. (Personal).

11. Montayne, John, Logistics Management Division, SINCGARS, Ft. Monmouth, N.J., 12 July 1984 (Personal) and 21 August 1984 (Telephone).

12. McEldery, Jim, Item Manager, VRC-12 Series and PRC-77 radios, Directorate for Materiel Management, CECOM, Ft. Monmouth, N.J. 21 August 1984 (telephone), and 12 September 1984 (Personal).

13. Hanson, John, J., Weapon System Support Office, Army Materiel Command, Alexandria, Va., 21 August 1984 (Telephone).

14. Sosnowski, John, LTC., Chief, Logistics Management Division, SINCGARS, Ft. Monmouth, N.J. 29 March 1984 (Personal).

15. Palante, Frank, Principal Contracting Officer, Directorate for Procurement, Ft. Monmouth, N.J., 9 July 1984, 14 September 1984, and 1 November 1984 (Personal).

16. Gulizia, Albert, Materiel Fielding Division, SINCGARS, Ft. Monmouth, N.J. 24 August 1984, and 1 November 1984 (Telephone).

17. Plumeri, Charles, DR., Directorate for Plans, Concepts and Evaluation, Ft. Monmouth, N.J., 7 September 1984 (Telephone), and 14 September 1984 (Personal).

18. Fornecker, Christopher, MAJ., Department of the Army System Coordinator, Deputy Chief of Staff Research, Development, and Acquisition, the Pentagon, 12 September 1984 (Personal).

19. White, Robert, LTC. Product Manager, Test Equipment Modernization, Ft. Monmouth, N.J., 14 September 1984 (Personal).

20. Gaines, David, MAJ., Executive Manager for Installation Units, Directorate for Materiel Management, CECOM, Ft. Monmouth, N.J., 13 September 1984 (Personal).

21. Newell, William Contracts Specialist, Directorate for Procurement and Production, CECOM, Ft. Monmouth, N.J., 11 September 1984 (Personal).

22. McCammon, Thomas, Automated Test Support Systems, PM-TMDE, Ft. Monmouth, N.J., 14 September 1984 (Personal).

23. Maltais, Richard, MAJ. Installation Kit Project Officer, SINCGARS, Ft. Monmouth, N.J., 13 September 1984 (Personal).

24. Hewitt, William F., Deputy Project Manager (Test) SINCGARS, Ft. Monmouth, N.J., 31 October 1984 (Personal).

APPENDIX B

INSTALLATION KIT AND ACCESSORY KIT

5820-450-6804 MK-1234/GRC AN/VRC-46, 53, -64 () AN/GRC-125, -160 () M151, A1

5820-930-3876	ANTENNA MOUNT ASSY	EACH	1
5985-930-7223	ANTENNA TIP ASSY	EACH	1
5820-856-9165	AUDIO ACCY SUP KIT	EACH	1
5995-823-2987	CABLE ASSY	EACH	1
5995-889-1253	CABLE ASSY	EACH	1
5995-823-2821	CABLE ASSY	EACH	1
5820-752-5738	CLAMP STRAP KIT	EACH	2
5325-276-6089	GROMMET, RUB	EACH	2
5820-856-7819	GUARD ASSY	EACH	1
5965-892-1010	HEADSET, ELEC	EACH	1
5965-179-7762	MICROPHONE, D	EACH	1
5820-893-1323	MOUNTING	EACH	1
5820-875-0905	REFLECTOR PLATE ASSY	EACH	1
5820-875-0932	SUPPORT BRACKET	EACH	1
5940-636-5761	TERMINAL, LUG	EACH	2
7610-856-0621	INSTALLATION INST	EACH	1
5820-740-1780	SUPPORT ASSY	EACH	1

5820-401-9697 MK-1455/GRC AN/VRC-24, A W AN/VRC-12 SERIES M151

5820-752-5738	CLAMP STRAP KIT	EACH	1
5820-857-1252	IMPEDANCE	EACH	1
5820-875-1024	DIAGRAM	EACH	1
5820-892-3340	CONTROL, RADIO	EACH	1
5995-823-2834	CABLE ASSY	EACH	1
5995-823-2836	CABLE ASSY	EACH	1
7650-875-0909	DRAWING, TECH	EACH	1

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